

Prof. Callendar ... }	Near Oropesa.	Experiments on coronal radiation. Photography of the red and green regions of the spectrum of the chromosphere and corona.
Prof. A. Fowler ... }		Search for intra-mercurial planet. Large scale corona photographs. Polarisation observations. Spectroscopic photographs of chromosphere and corona.
Lick Observers ...		
		Prismatic camera (three prisms) photographs of chromosphere & corona. Large scale prismatic reflector photographs of chromosphere & corona. Small scale photographs of corona.
<i>Algeria.</i>		
Sir Norman Lockyer }	Near Philippeville ...	Spectroscopic and polarimetric observations.
Dr. W. J. S. Lockyer }		
Mr. C. P. Butler ...		
Mr. H. F. Newall... Near Bona ...		
<i>Tunis.</i>		
The Astronomer Royal ...	Sfax ...	Photographs of the corona on 4-inch and 1½-inch scales. Spectra of chromosphere & corona with Major Hills's spectrometers.
Mr. F. W. Dyson ...		
Mr. Davidson ...		
<i>Egypt.</i>		
Prof. Turner	Polarimetric observations. Corona photographs with Abney doublet. (Large scale photographs of the corona?)
Mr. Bellamy ...		
Lick Observers ...		
		Search for intra-mercurial planets. Large scale corona photographs. Integrating spectroscopic photographs.

One of the novelties that will be attempted during this eclipse will be the photography of the eclipsed sun by means of the three-colour process. The camera that will be employed will probably be one having three lenses, so that the exposures through the three coloured screens can be made simultaneously, the correct ratio of the exposures being obtained by adjusting the apertures of the lenses.

When it is considered that in addition to these parties there will most probably be expeditions from several other countries, such as Spain, Portugal, Holland, France, Germany, Italy, Russia, Egypt, &c., and probably one or two more United States expeditions, there is a great opportunity not only for occupying a large number of different stations along the line, but of gaining a quantity of valuable material to enlarge our knowledge of solar physics.

WILLIAM J. S. LOCKYER.

THE CEYLON PEARL FISHERIES.¹

LITTLE enough is done by the State in this country in the matter of aiding scientific research, and this is especially true of biological science. To this attitude of indifference, or aloofness, we have grown accustomed; abroad it is a subject for uncomplimentary comment. This attitude cannot be due to the conviction on the part of our ministers that "science is bankrupt," since when some great industry is threatened by injuries which legislation is powerless

¹ "Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar." By W. A. Herdman, D.Sc., F.R.S., &c. Part ii. Pp. viii+300. (London: The Royal Society, 1904.)

to check, or some pest is threatening the welfare of the community, the aid of the man of science is at once invoked.

The Pearl Fishery Commission is a striking example of the intervention of the State to aid a crippled industry by calling in the aid of the biologist.

The series of barren years alternating in some mysterious way with years of plenty puzzled those engaged in this fishery for more than two centuries, and, moreover, seriously reduced the profits of the fishing. To fathom this strange uncertainty, and if possible to find means whereby more uniform harvests could be ensured, the Government submitted the matter to a commission of inquiry, which has been held under the auspices of the Ceylon Government. The results of this inquiry have abundantly justified those responsible for its inception, and should do much to establish the advisability of instituting inquiries into other problems to which we could point that can only be dealt with by trained and experienced biologists.

The second part of Prof. Herdman's report to this commission in no wise suffers by comparison with the first volume. It is a very mine of information, yielding rich lodes of fact without the trouble of any preliminary crushing or sifting.

This report opens with a luminous review of the history of the principal fisheries from 1801 to the present time, and should prove of the highest value to those engaged in pearl fishing in future, for the causes of the rise, zenith, and decline of the different fisheries between these dates have been analysed and tabulated.

It is now established beyond doubt that the normal life of the pearl oyster does not average more than five years, and that these, especially to an animal so peacefully disposed as an oyster, are full of catastrophes and rumours of catastrophes!

By way of illustration as to the truth of this, we may well select an instance or so from this report. On the "Kondatchi Paar" in March, 1902, there were about 5,750,000 oysters. By March, 1903, these had been almost entirely wiped out of existence—eaten by starfish! File-fishes and enormous rays also show an insatiable appetite for oysters, and in the course of a few months will devour millions! Not seldom these oysters are smothered or killed by the invasion of hordes of young of their own species. But this is not all. Shifting sands may overwhelm incredible hosts, and millions are swept away by currents.

Man, says Prof. Herdman, "can do comparatively little to mitigate the severity of such influences as tell against the life and prosperity of the Pearl Oyster."

But it is just because he can do so little that there is so great a need of a vigilant and intelligent watch being constantly kept on the different fishing grounds. To a very considerable extent, Prof. Herdman has shown that man can make good these ravages, or snatch the remnant at least of a disappearing host from destruction. His plan is to transplant young oysters from beds known to be dangerous into more sheltered areas. This rescue work is to be further turned to account by using the waifs and strays, which are to be garnered by the inspection vessel, for restocking old beds, where they may grow and thrive—and become infected by the chosen parasite to keep up the growth of pearls of great price!

To ensure this infection is one of the problems which Mr. Hornell, the inspector of fisheries, is to solve.

The life of the pearl oyster is, as we have remarked, about five years, and it is from those of this age that the finest pearls are obtained. Herein lies a danger, since there is always a strong temptation to delay fishing as long as possible to ensure big pearls. Unless, as Prof. Herdman points out, these beds be carefully watched, one of the many catastrophes which attend pearl oysters may carry off this precious crop before

it can be gathered. A case in point is given by Prof. Herdman. The Mutuvaratu Paar, which lies to the south-west of Karativo Island, yielded during 1889, 1890, and 1891 some 117,000,000 oysters, which realised very nearly 1,000,000 rupees—the only fishery since 1814 that has returned so large a sum. The oysters raised during these three years steadily increased in value, those lifted in 1891—the oldest—being by far the most valuable. "But the record," he remarks, "shows the risk there is in trying for the enhanced value by delaying the fishery once the oysters are over 5 years of age. In 1891 this bed must have been 6 years old, and they are described as rapidly dying off, many being dead and putrid."

There are prospects of a good fishing for next year and 1906, but the results of 1907 and the succeeding years depend largely, it is pointed out, on extensive measures of transplantation being undertaken without delay. This Mr. Hornell will doubtless accomplish.

Prof. Herdman's memoir on the anatomy of the pearl oyster adds much to our knowledge of the subject, and contains some valuable observations on the living animal. As an instance of the latter we may

anchored by the threads of which this is composed. Under a great strain these break, and are renewed again within an hour or so, the root of the old byssus being sloughed off.

Some interesting points concerning gill structure are given, especially with regard to the passage from inter-filamentar junctions by ciliated discs to junctions by organic union.

With regard to sense organs, the pearl oyster is not very well provided. But a distinct response is shown to the stimulus of light and shadow—"a sensibility which may be termed dermatoptic," and appears to be located in the edges of the mantle and the surface of the foot, where patches of more or less deeply pigmented epithelial cells are met with.

All kinds of creatures seem to find the pearl oyster a particularly "toothsome" morsel, man alone excepted, who prefers to make manure of their bodies for the sake of possible pearls contained therein.

No less than seven different kinds of parasitic worms are now known from the pearl oyster, six of which are new species described in this volume. Of these, only one, a cestode larva (*Tetrarhynchus unionifactor*), appears to be concerned in the formation of cyst pearls. This fact is interesting, inasmuch as the formation of similar pearls in European mussels is due to the cercaria of trematodes.

As to the sequence of hosts called upon to nurse this precious cestode of the pearl oyster to maturity much uncertainty prevails. It was thought that file-fishes and elasmobranchs were the intermediate vertebrate hosts, and this will probably prove to be the case.

Certain novel features seem to be foreshadowed in the life-history of this parasite when the chain of evidence is complete.

To begin with, it would appear that it enters its first host—the pearl oyster

—as a free-swimming planaria-like larva, inasmuch as certain larvae of this type, but containing calcareous corpuscles recalling those of cestodes, were taken in plankton, and these bear, in many features, a close resemblance to the earliest encysted larvae found in the pearl oyster.

It is assumed that these free-swimming forms are tetrarhynchids, though hitherto it has been believed that tetrarhynchid larvae make their way into their first hosts while still encased within the egg-shell. The boethiocephalids have free-swimming larvae, but these are ciliated. That the larvae in question must be tetrarhynchids seems certain, since older larvae, showing several stages of development, belonged unquestionably to the genus *Tetrarhynchus*.

It was believed that these larvae were next ingested by file-fishes (*Balistes*), but it now appears that the tetrarhynchid larvae of *Balistes*, of which three species are described in this report, are quite distinct forms, distinguished by the presence of a vesicle, which is wanting in the pearl oyster larvae. Further, the more advanced larvae of the pearl oyster have arrived at a later stage of development than the larvae found in *Balistes*.

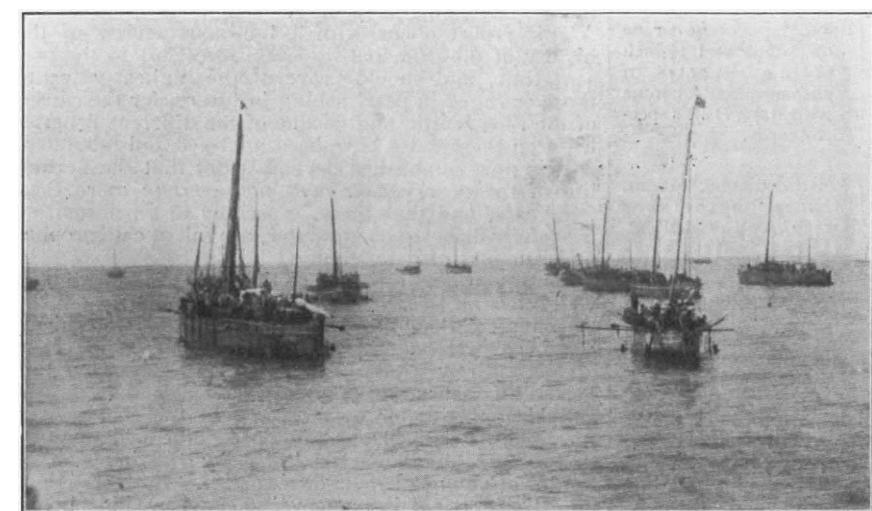


FIG. 1.—Pearl-fishing Fleet at work on the Cheval Paar.

cite his remarks on the functions of the foot. These, he points out, "are three-fold: the distal ventral surface subserves locomotion; the median and posterior parts effect attachment by means of the byssal fibres; and lastly, on account of the general mobility of the organ, and probably of its sensory nature, the tip is of great use in clearing the gills and mantle from the intrusive particles that cannot otherwise be got rid of."

It is concerning the latter function that we would direct special attention here. In the living animal Prof. Herdman has observed the foot "pushed between the gill-plate, and over the inner surface of the mantle gently stroking the surface and insinuating itself into the crevices, thus freeing the parts from any foreign bodies . . . that might cause inconvenience."

Mr. Hornell observed one oyster, which had sustained an injury to the mantle, pass the foot-tip gently around the edges of the wound so as to work off the particles of dirt collected there. The tip was even passed through the wound to make the cleansing the more thorough.

Concerning the byssus, it is interesting to notice that the operation of dredging for oysters for transplantation in no wise injures the animal when

The final stage of the pearl oyster cestode was supposed to be undergone within the body of an elasmobranch which fed upon *Balistes*. But, so far, the only elasmobranch tetrarhynchid which the authors have examined was obtained from the spiral valve of a sting ray (*Taeniura melanospilos*), and this larva was of a species quite distinct from either the *Balistes* or oyster larvæ. It is to be noted, however, that from this ray two perfect specimens of *Balistes* were taken.

Thus, though we may yet find that the sequence of hosts is as was indicated in the first volume of this report, we are at present left somewhat in doubt. In due time, doubtless, Messrs. Shipley and Hornell, the authors of this really fascinating section, will solve the riddle.

We have dealt at some length on this matter because, apart from its interest as a sequence of stirring events in the life-history of a very humble organism, it has considerable importance from an economic point of view: since, when the chain of evidence is complete, it may be possible, as was first suggested by Keelart in 1857, to raise the percentage of pearls by infecting oysters in other beds with their parasites.

Prof. Jeffrey Bell contributes some notes on the echinoderms, appended to a description of the species collected, by Prof. Herdman. Although these notes barely fill three pages, Prof. Bell has crowded into this space some trenchant criticisms and some really valuable facts.

The reports on the arthropods are full of interesting matter, and deal with a large number of new species; but we venture to think that a longer summary of the principal results arrived at would have added to the usefulness of these chapters. Dr. Calman's work on the Cumacea will be welcomed, inasmuch as no species of this group have hitherto been described from any part of the Indian Ocean.

The collection of cephalopods has been worked out by Dr. W. E. Hoyle. Though small, it contained one new species of unusual interest. This was a small octopus, which has been named *Polypus arborescens* on account of the presence of curious branched processes scattered all over the body, some of which are surmounted by a tuft of fibrils. After a most careful study Dr. Hoyle is still uncertain as to their purpose. He dwells at considerable length upon their microscopical structure. He is satisfied that they are not parasitic organisms, nor are they, he considers, glandular or phosphorescent organs. The fact that no nerves have been traced to them would seem to show that they are not tactile bodies, yet on the whole he considers that it is this function which they perform. Prof. Herdman, who has studied the living animal in a small tank, describes these mysterious processes as being contractile, and "kept frequently moving—uncoiling to a considerable length and then curling up again suddenly." This seems to suggest that they may be alluring organs comparable to the waving flag of the angler-fish or the long, worm-like tongue of the "mata-mata" tortoise.

The fishes collected during this investigation have been described by Mr. J. Johnstone. Twelve species in all are dealt with.

The most interesting feature of this report is that concerning the supposed naso-pharyngeal passage in *Cynoglossus*. Kyle, in 1900, described in this genus a curious nasal sac, which, he believed, communicated with the mouth by means of a pore in the floor of the sac, a feature which he regarded as of considerable morphological importance.

Mr. Johnstone examined several species belonging to this genus, and in no case did he find this naso-pharyngeal passage. But what is really interesting is the fact that he found this cavity, on more than one occasion, inhabited by a copepod. Since this creature

anchors itself by hooks, the presence of an occasional hole in the floor of this chamber is not to be wondered at!

There is a wealth of plates in this volume, all of which are as good of their kind as one could wish. The same cannot be said of one or two of the text figures, however, which leave much to be desired—notably the figure of the dissection of a pearl oyster on p. 43.

Yet another volume is required to complete this report; this is promised early next year. Judging by the standard set by the two volumes now issued, the complete work will form one of the most valuable commentaries on a great industry yet issued.

W. P. P.

NOTES.

At the invitation of the British Association, the local committee in Johannesburg has nominated the following as vice-presidents and secretaries respectively of the different sections for the meeting in South Africa, the general arrangements of which were described in NATURE of February 2 (p. 323):—*Mathematics and Physical Science*—vice-president, Dr. Breyer; secretary, Mr. R. T. A. Innes. *Chemistry*—Mr. J. R. Williams, Mr. W. A. Caldecott. *Geology*—Dr. Corstorphine, Dr. Molengraaff. *Zoology*—Dr. Gunning, Dr. Pakes. *Geography*, Mr. E. H. V. Melville, Mr. F. Flowers. *Economic Science and Statistics*—Mr. S. Evans, Mr. Robert A. Ababrelton. *Engineering*—Mr. S. Jennings, Mr. E. Williams. *Anthropology*—Dr. Schonland, Mr. A. von Dessauer. *Physiology*—Sir Kendal Franks, Dr. A. Mackenzie. *Botany*—Mr. Burtt Davy, Prof. Pearson. *Educational Science*—Mr. E. B. Sargent, Prof. Hele-Shaw.

THE Hunterian oration delivered by Mr. John Tweedy at the Royal College of Surgeons on February 14, and abridged elsewhere in this issue, contains several interesting references to the growth of natural knowledge by the use of the experimental method, with illustrations from John Hunter's work. It has been said that though Hunter had never read Bacon, his method was as strictly Baconian as if he had. Mr. Tweedy pointed out that this view is based upon a complete misinterpretation of the Baconian system. Francis Bacon himself neither knew nor understood the physical sciences, and his spirit was much less modern than that of his illustrious namesake, Roger Bacon, who lived three hundred years before him. John Hunter did not follow the mechanical methods of the Baconian system, but he possessed every moral and intellectual qualification for useful scientific research—a fertile imagination ready to suggest possible relations of facts, openness of mind, and a conscientious scientific spirit that submitted every hypothesis to the test of observation and experiment, taking nothing on trust. Mr. Tweedy occupied the chair at the festival dinner held at the college in the evening of February 14, when there were present, among others:—Prof. C. Allbutt, Sir W. Broadbent, Sir Lauder Brunton, Sir D. Duckworth, Sir Harry Johnston, Sir Norman Lockyer, Sir W. Ramsay, Prof. C. Stewart, Sir W. T. Thiselton-Dyer, Prof. W. A. Tilden, and Sir F. Treves.

THE death on February 9, at the age of forty-four, of Mr. F. O. Pickard-Cambridge makes a break it will be impossible to fill in the ranks of British arachnologists. From boyhood he had devoted himself to the study of English spiders, and was rightly regarded as the leading authority upon this subject. He completed, moreover, in 1904, his monograph of the Central American spiders for